

Introduction to Pollution Prevention & Waste Reduction

**An excerpt from
*Clearing the Air on Clean Air:
Strategies for Perc Dry Cleaners***

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INTRODUCTION TO POLLUTION PREVENTION & WASTE REDUCTION

Our environmental protection efforts in this country emphasize the control and cleanup of pollution caused by hazardous materials when they become hazardous wastes. Today, pollution prevention at the source is emphasized as is reuse and recycling. In order to run your shop as economically and efficiently as possible, all types of wastes including hazardous wastes, solid wastes, air emissions, and water discharges should be targeted for reduction. It has become apparent that there are shortfalls in the command and control, end-of-pipe regulations.

EPA and the states' pollution prevention and waste reduction policies and laws are based and promoted on human health and environmental concerns. Pollution prevention and waste reduction have positive impacts on businesses and industry such as economic returns from reduced costs in raw materials, waste treatment and/or disposal. Elimination of wastes reduces liabilities. Companies that reduce their wastes also improve their public image in the community.

Pollution prevention (P2) or source reduction involves reducing the amount of waste exiting a process such as dry cleaning. Source reduction includes:

- Process or procedure modifications;
- Equipment or technology modifications;
- Substitution of raw materials or improvements in feedstock purity;
- Reformulation or redesign of products;
- Improvements in housekeeping, maintenance, training, or inventory control; and
- Recycling within a process such as the close-looped distillation of perc.

A dry-to-dry machine is a modification (required when transfer machine needs replacement) which reduces the amount of perc used in the cleaning process. Retrofitting a vented system to a no-vent system is an equipment modification which reduces air emissions and perc consumption.

Recycling is the use, reuse, or reclamation of a waste either on-site or off-site after it is generated by a particular process. Recycling can be an effective substitute for a commercial product or as an ingredient or feedstock in an industrial process. Recycling also refers to the reclamation of useful constituent fractions within a waste material or removal of contaminants from a waste to allow it to be reused.

Capturing perc emissions with carbon adsorption and refrigerated condensers and returning it to the process is an example of reuse. Perc recovered from draining cartridge filters is an example of recycling.

Once the sources of pollution within dry cleaning plants are identified, solutions are easily found that help you reduce or eliminate the generation of these wastes through source reduction, reuse and recycling. There will still be end-of-the-pipe requirements but it is this group's hope that by using a joint industry - government effort, the cost of complying with any future regulations will be significantly reduced or in some cases eliminated altogether.

Inputs into a dry cleaning operation determines what will come out of it. Identifying pollutants and problems isn't easy. Its complexity varies from location to location depending on the size of the facility, the volume of perc consumed, the garment usage profile of the customers, and the specifics of local, state, and federal requirements.

Organizations need to recognize the possible benefits to be gained from waste reduction efforts even if it is considered a long-term ideal rather than an immediate goal. Waste reduction makes sense in today's competitive marketplace. Clearly, the need to minimize the volume and toxicity of all solid and hazardous waste is apparent.

STATE INITIATIVES

In response to a growing concern that solid and hazardous waste problems needed far more attention than they previously had received, many states passed legislation that established state solid and hazardous waste reduction policies with P2/waste reduction programs. Most of these "facility planning laws" mandate waste reduction planning with voluntary implementation.

These requirements are intended to increase the awareness of generators and facility owners and operators of the importance of reducing solid and hazardous wastes. A quality management planning approach can serve as the basis for more process specific assessment of pollution prevention opportunities. Each generator must determine whether any particular pollution prevention or waste minimization approach that might apply to a process is economically practicable.

Most companies will embrace the concept but do not implement best management

procedures. Therefore, a mix of incentives and waste management controls should be in place to encourage participation. Until the true costs of waste management are calculated and understood, unnecessary hazardous waste will be produced and additional costs will be incurred.

The goal of reducing the generation of waste will require a commitment to waste prevention and reduction in businesses and industry through education, planning, and technical assistance programs. Check with your states' Ombudsman, Small Business Assistance Programs, and Pollution Prevention/Waste Reduction Programs for assistance and training opportunities that will help you stay in compliance. In many cases, their services are free and can be nonregulatory.

This manual presents several opportunities for reducing solid and hazardous waste generation for dry cleaners. They should all be carefully evaluated. Opportunities to reduce the volume of non-hazardous solid wastes through better supplier partnerships may exist. Some options for reducing solid wastes are also presented. Dry cleaners' (corporate) management must make a strong commitment to a continuing waste reduction program and improved supplier partnerships if their plants are to achieve waste reduction.

ESTABLISH A WASTE REDUCTION PROGRAM

Opportunities for waste reduction are present in every operation, unless **ALL** waste streams are eliminated or have been reduced to the lowest levels technically and economically achievable. Pollution prevention/waste reduction strategies have focused largely on process and procedure modifications and product reformation.

Some businesses have improved the marketability of their products through the implementation of an internal waste reduction program. Some dry cleaners advertise hanger and poly recycling and report this has improved their public image and possibly their competitive status with other businesses. Good housekeeping has also been mentioned as something that helped to increase business revenue and prevent waste.

The way to take advantage of waste reduction opportunities is to establish a program to identify and capitalize on them. The essential elements of an effective company-wide program are:

- **TOP MANAGEMENT COMMITMENT AND SUPPORT**
- **EXPLICITLY DEFINED PROGRAM AND OBJECTIVES**

- **ACCURATE ACCOUNTING OF WASTE STREAMS AND THEIR TRUE COSTS**
- **A PERVASIVE WASTE REDUCTION ETHIC**
- **INFORMATION AND TECHNOLOGY SOURCES**
- **PERIODIC PROGRAM EVALUATION AND REASSESSMENT OF WASTE REDUCTION OPPORTUNITIES**

None of the elements is measurably more important than another and a program will rarely be more than partially effective unless all those listed are present.

The program must have a set of GOALS which should be:

- **ACCEPTABLE** to those who will work to achieve them.
- **FLEXIBLE** to adapt to changing requirements.
- **MEASURABLE** over time.
- **SUITABLE** to the overall corporate goals.
- **UNDERSTANDABLE.**
- **ACHIEVABLE** with a practical level of effort.

The final element of a successful waste reduction program is continuing evaluation and updating. To plan future pollution prevention and waste reduction efforts, businesses must establish a means of documenting and evaluating current and past efforts.

Involvement by All Employees

Waste reduction must be accepted as the responsibility of all workers and managers involved in the dry cleaning process rather than just the few who are responsible for pollution control and compliance at the plant.

Employee Training and Motivation

An employee training program ensures that every person storing or handling hazardous material is aware of the potential of a hazardous material becoming hazardous waste. Many have initiated such training and awareness programs to keep employees informed of waste reduction advances and goals; and, some have established reward programs for employees who provide suggestions leading to successful waste reduction.

Good Housekeeping

Good housekeeping measures can greatly decrease the amount of wastes that are

generated. Large amounts of solid and/or hazardous waste may be generated through spills and leaks, improper storage practices, inefficient production start-up or shut-down, scheduling problems, lack of emergency procedures and preventive maintenance, or poorly calibrated devices for pollution control processes. New manuals of standard procedures and routine training and retraining can eliminate this problem. These procedures may significantly reduce waste at the source.

Maintenance

Reducing wastes through good operating practices is achieved by using maintenance and preventative maintenance to reduce incidents of equipment breakdowns, inefficiency, or process fluid and chemical leakage. Liquid and laundry chemical leaks can be eliminated by conducting a regular maintenance program. More effort should be focused on the wastes generated by these activities. Separate and handle the solvents, oils and greases generated during these procedures properly.

Corrective maintenance, such as resetting control valves or adjusting process temperatures, increases efficiency and prevent raw material and energy loss through waste streams. Preventive maintenance helps reduce down-time and wastes produced during the procedure.

Waste Reduction Assessment

The initial step to accomplishing pollution prevention is to conduct a waste reduction assessment. This assessment is a systematic, planned procedure with the objective of identifying ways to reduce or eliminate waste. The required leak detection inspections and monitoring activities and the waste reduction assessment can be accomplished together.

The assessment consists of a careful review of a plant's operations and wastes and the selection of specific areas to assess for opportunities. After focusing on a specific waste or area, a number of options with the potential to minimize waste are developed and screened. For each opportunity, further discussion and brainstorming with employees should produce a list of options to be considered for implementation. The objective is to stimulate alternative reduction methods rather than to select from prepared options.

Finally, the technical and economic feasibility of the selected options are evaluated. Those which represent the highest return on the time, effort, and funds invested should be implemented first.

Waste Reduction Practices

Nationwide there are many commercial dry cleaning establishments and industrial laundries that use perc to remove difficult soils from textiles. Some of the wastes generated from the perc dry cleaning process and packaging are vapor emissions, still bottoms, muck residues (cooked), spent filter cartridges, wastewater, and solid wastes (i.e., drums, pallets, cardboard, hangers, poly, etc.).

Remember, waste reduction is successful only when top management is committed to the program and goals **and** employees are trained and involved to achieve the goals.

VAPOR EMISSIONS

Existing Conditions

Process emissions occur during washing, aeration, still and other equipment operation and door openings. These emissions account for as much as 74 percent of total perc losses. Fugitive emissions occur from the evaporation during clothes transfer, equipment leaks, losses during solvent transfer, and evaporation from spent filters and distillation wastes.

The most common methods of reducing solvent emissions involve carbon adsorption beds and refrigerated condensers. When coupled with transfer and dry-to-dry technologies, these reduction methods significantly reduce process and fugitive emissions.

Regulatory Requirements

As discussed earlier in this handbook, the new Clean Air Act Amendments (CAAA) regulate process emissions. State and local air authorities may have more stringent requirements. Discussion of additional recommendations that provide additional benefits for dry cleaners follows.

Recommendations

Carbon Adsorbers

- Install floor vents which draw fugitive vapors from around the dry cleaning and auxiliary equipment into the absorber.
- Do not open the door (if the machine can be opened) before the end of the drying

cycle. Air streams may be vented to a carbon bed when the machine door is open.

- Determine and maintain the maximum or ideal ratio of clothes cleaned per activated carbon used.
- Carbon beds should maintain the ideal solvent to carbon ratio to ensure that the stripping is done at proper intervals according to equipment manufacturing instructions.
- Determine and maintain the ideal rated air flow capacity through the carbon bed.
- Determine and maintain ideal steam pressure passed through the bed to “strip” solvents from the carbon bed.

Refrigerated Condensers

- Maintain the proper condensing coil in- and out-temperatures.

Equipment Leaks

- Purchase a halogenated hydrocarbon detector to monitor vapor losses. Up to 25% of solvent emissions can be attributed to equipment leaks. EPA’s requirements for leak detection are minimal. EPA states that, “Any perchloroethylene vapor or liquid leaks that are obvious from:

- (1) The odor of perchloroethylene;
 - (2) Visual observation, such as pools or droplets of liquid; or
 - (3) The detection of gas flow by passing the fingers over the surface of equipment.”
- A detector makes routine inspections quicker and more accurate. Training and involvement of several employees ensures that someone is always available to monitor for leaks.

Remember: If fugitive equipment leaks are detected, begin the process of repair within 24 hours. Parts should be ordered within 2 days and installed within 5 days of receipt of parts. Completed maintenance measures and corrective actions taken to repair identified leaks should be documented.

- To reduce transfer solvent vapor losses, convert to a dry-to-dry machine.

Best Management Practices (BMPs) and Preventive Maintenance

Good operational control for waste reduction is defined as a **procedure or policy** in an organization that reduces the generation of multi-media wastes. Better standard procedures usually relate to production (organizational structure, housekeeping improvements, initiatives, operations planning and control) rather than raw materials and design factors. Initial policy deployment by management provides information on BMPs and monitoring.

- Replace the seals regularly on the dryer deodorizer and aeration valves.
- Check the air relief valves for proper enclosure.
- Open the button and lint traps just long enough to clean and only when necessary. Inspect the door gaskets on the button trap. Inspect lint and button traps more often since they are normally opened daily. Dry lint on the button trap gasket can cause a perc leak — clean gaskets thoroughly prior to seating.
- Inspect the gaskets around the cleaning machine door.
- Repair any holes in the air and exhaust ducts.
- Clean the lint screens as often as necessary to avoid clogging the fans and condensers.

Better Standard Operating Procedures

A business's first step in a waste reduction program can be to change procedures. Improving operating procedures reduces accidental and material losses while maintaining or increasing productivity. Improved procedures can range from a change in management approach to a change in waste handling procedures. Proper procedures to reduce waste are part of the overall operating plan for a business.

- Avoid underloading or overloading of machines.
- Place saturated lint from lint baskets in sealed waste containers.
- Inspect waste storage containers for leaks.

STILL BOTTOMS

Existing Conditions

The principal method for purifying and recovering solvent in dry cleaning operations is on-site distillation. Still bottoms may contain as much as 50 percent solvent in addition to nonvolatile residues (i.e., detergent, sizing, waxes, oils, and greases).

Regulatory Requirements

Still bottoms are a RCRA hazardous waste and are subject to disposal regulations issued by EPA and the states. After manifesting, a licensed treatment, storage, and disposal facility (TSDF) should manage perc wastes, including still bottoms.

Recommendations

The addition of steam enhances distillation by mixing with still residues to form a perc/water azeotrope that boils at a lower temperature than pure perc. The distillation rate increases and perc separates more completely from nonvolatile contaminants. However, there is an increase in wastewater.

- To recover more solvent or reduce solvent residue, redistill the residue by adding water after boil-down.
- Regularly remove the residues in distillation units. Excessive buildup of contaminants in the still can reduce the efficiency of the distillation process.
- Minimize solvent emissions from distillation units by ducting vents directly to carbon beds and refrigerated condensers if it's economically feasible.

MUCK

Existing Conditions

Dirty solvent when filtered yields reusable solvent and muck. The muck from filters may contain considerable quantities of solvent. Muck cookers achieve significant solvent reduction through condensing and reclaiming emissions.

Regulatory Requirements

Filter muck is a RCRA hazardous waste and must be disposed of in accordance with

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Filter muck is a RCRA hazardous waste and must be disposed of in accordance with regulations issued by EPA and the states. Muck wastes should be manifested and managed by a licensed treatment, storage, and disposal facility (TSDF).

Recommendations

Adhere to concentration limits for the waste material after cooking to ensure good operation of the muck cooker in minimizing perc content before disposal.

- Determine the feasibility of ducting unrecovered emissions from cookers to carbon beds or refrigerated condensers for reclamation of additional solvent if it's economically feasible.

CARTRIDGE FILTERS

Background

Cartridge filters with carbon-cores are the most common type of filter used in dry cleaning. There are other types of filters used. They include powder, disc, and polishing units. However, only cartridge filters with carbon cores are discussed.

Regulatory Requirements

Spent cartridge filters are a RCRA hazardous waste and subject to the regulations issued by EPA and the states. Manifest spent filters and allow a licensed treatment, storage, and disposal facility (TSDF) to manage them.

Recommendations

Drain cartridges for a minimum of 24 hours in a closed container. Undrained cartridges may contain as much as one gallon (13 pounds) of solvent.

- Consider draining filter cartridges over a weekend.
- Consider drying filters in housings vented to carbon adsorbers. The amount of perc recovered is sometimes too low to make this option economically worthwhile. The owner/operator should determine the economic feasibility of this option.
- To recover more solvent or reduce solvent residue, use a cartridge stripper to remove solvent from the cartridge and determine the optimum stripping time for your process. Presently, one quarter of commercial dry cleaners use steam to strip spent cartridges.

- Determine and maintain the ideal amount of clothes cleaned for each standard cartridge before stripping.
- Determine the ideal steam pressure for stripping cartridges.
- Consider using hot air and venting to a carbon bed or refrigerated condenser when stripping cartridges to reduce wastewater generation. Kleen-Rite, Inc. (St. Louis, MO) has pioneered this technology.

WASTEWATER

Existing Conditions

Perc is not very soluble in water. Nevertheless, process wastewater will contain about 150 ppm (0.015 percent) solvent. Dry cleaning establishments that launder industrial rags (shop towels), garments, and other textiles have significant levels of perc in the wastewater. In addition, the recovery of perc from vapors routed to water separators from condensers, carbon adsorbers, cartridge strippers, stills, and muck cookers can yield water-contaminated solvent.

Routing solvents to a water separator will allow recovery of the heavier solvent. The solvent is ultimately returned to the tank. Drained water from the top of the separator may be passed through one or more carbon filters to reduce perc levels before discharge to the sewer.

Regulatory Requirements

Publicly-owned treatment works (POTWs) will vary in the allowable amounts of perc to be accepted. However, sewer pipes that leak perc wastewater may include your plant in future liabilities. Consider using a technology that removes all perc from wastewater before discharge. Placing free phase perc in an evaporator is prohibited.

Recommendations

- Consider buying separator water evaporators that are exempt from RCRA permitting. These units have filters designed to yield perc-free water that eventually evaporates from the unit.

DRUMS

Existing Conditions

Drums are used to contain virgin materials and store hazardous wastes.

Regulatory Requirements

Improper management of drums can lead to costly fines and unnecessary spills and leaks. Under the Resource Conservation and Recovery Act (RCRA), generators must weekly inspect hazardous waste storage areas for spills and leaks.

Recommendations

- Request that your supplier provide solvents in returnable drums. If the supplier delivers in bulk using a hose, ensure that leak and spill procedures are followed during delivery to reduce emissions and safety risks.
- Use spigots and pumps when dispensing new materials and funnels when transferring wastes to storage containers to reduce the possibility of spills and evaporative losses. Transferring by hand and using open buckets will increase solvent loss.
- Label all containers of raw materials properly.
- Store solvent and solvent waste drums under cover to prevent rusting and ensure that you comply with all storm water run-off regulations.
- Do not store drums in extreme heat or cold where shelf-life will be diminished or product will be unusable.
- Store solvent and wastes in tightly sealed containers that are impervious to the solvent and chemical reactions.
- Provide secondary containment in areas where solvents and solvent wastes are stored.

A waste reduction program and plan will also incorporate the following practices:

RESOURCE CONSERVATION PROGRAMS

Instituting a comprehensive conservation program can save money and valuable resources. For example:

- Using the latest technology or new equipment may require less energy, water and chemicals to operate properly and may reduce cycle times. Converting to a dry-to-dry machine reduces energy and perc consumption.
- Monitoring your water, gas and electric meters routinely is necessary. Identify peaks and valleys for usage during the day and week and what measures might reduce usage. Determine if there are activities that consume water, gas and electricity that could be curtailed during non-production hours.

Utility and water consumption are tracked at most plants. In-process recycling on-site should be considered for heat energy at dry cleaners. The following questions should be asked:

- Is there a heat reclamation system in use and where is it located?
- Where is the reclaimed heat used?
- Can the efficiency of the existing system be improved?

PURCHASING , RAW MATERIALS & INVENTORY CONTROL

Instituting a comprehensive chemical review and purchasing program can save money and valuable resources and reduce toxics and waste. Standard procedures for inventory controls should be implemented or improved to ensure review of all chemical usage in the dry cleaning plant. Material and waste tracking systems including good inventory controls should be in-place at the plant.

Perc and chemical usage at the dry cleaning facilities should be documented including material safety data sheets (MSDSs) and amounts of chemicals used over periods of time. Dry cleaners should use just-in-time inventory controls with chemicals and adopt first-in, first-out practices to prevent expiration of products which creates waste.

Safety meetings should focus on proper handling and storage of all process chemicals to avoid health hazards and the generation of waste from spills and cleanup. Consider replacing your current raw materials with less toxic ones. Toxics use reduction in all process and treatment chemicals should be reviewed

periodically with your suppliers and vendors.

Management, environmental/safety staff, and suppliers must continue asking why are these chemicals used and how can their hazards and toxicity be reduced. Take into consideration the cost of treatment and disposal when deciding what raw materials are purchased and used in dry cleaning.

NON-HAZARDOUS SOLID WASTES

The non-hazardous wastes which are generated at dry cleaning plants consist mostly of miscellaneous shipping and packaging materials such as cardboard, plastic jugs and bags, pallets, and fiber and steel drums. At one plant, the dumpsters were estimated to be "80% cardboard and paper" along with dry lint. If a dry cleaner is not currently recycling these solid wastes, options available should be reviewed and implemented where feasible.

Waste Separation

When solid and hazardous waste is generated, proper handling and separation are necessary to maximize the reclamation potential of the waste material. Simple plans designating specific areas for separation of potentially valuable resources from unmarketable wastes will enable a company to achieve lower quantities of solid and hazardous wastes for disposal, lower disposal costs, and increased waste recycling.

- Do not allow nonhazardous materials to become contaminated with hazardous materials. Keep hazardous and nonhazardous wastes separate to increase their potential for reuse, recycling or treatment.

Reduce the Number of Empty Boxes, Bags, Jugs, Drums and Pallets

The quantity of small containers is great enough that alternate packaging in larger containers would cause a large reduction in the amount of solid waste being landfilled and empty containers to be handled. Determine the number of drums generated and track their handling and storage procedures and costs. Negotiate with your supplier to use returnable drums or bulk delivery of materials.

The concept of bulk or semi-bulk packaging bears exploration, even if some changes in the procedures used to distribute to the point of use or to dispense for use are necessary. Returnable "tote bins" may be impractical because of current equipment and accessibility, but if the current package is a standard steel drum, the

number of empty containers generated could be reduced significantly, potentially 90%. The number of incoming disposable pallets would also be considerably reduced.

For reusing and recycling 55 gallon drums, businesses usually return empty drums to the chemical supplier or deal with a cooperage company who reconditions and sells them. If your supplier will not accept empty drums, determine if a drum reclamation company will recondition your drums for resale. Drum reconditioners recycle steel drums which contain residues of organic materials by burning them out before straightening and repainting. Investigate drum recycling sites to ensure that your drums are managed responsibly and lawfully according to all local, state, and federal regulations.

If drum disposal is necessary, consider sending empty containers to scrap metal vendors. Visit your local scrap metal vendors to note how scrap is handled. Tour the company to monitor how the containers are managed. Ask questions on how your scrap should be stored and transported and how it is received and processed.

When asked about pallets most dry cleaners replied, "Sometimes they are taken by someone except the damaged ones which go to the dumpster." More focus should be placed on this waste by contacting suppliers about pallet reuse or elimination altogether.

Paper and Paper Products Recycling

Recycling paper products can reduce disposal costs. In almost every landfill, paper products represent the largest volume of waste present. As landfill space becomes more valuable, recycling paper products has great potential to extend the life of landfills. Recycling paper has not always been encouraged by paper mills, largely because they lacked capacity to handle the recycled material. This is no longer the case. Most will now buy corrugated board and some 35 grades of paper. High grade, office paper should be used on both-sides and then be separated and recycled.

Reuse of cardboard boxes can be accomplished by purchasing contracts which encourage the reuse of raw material shipping containers. Reuse of corrugated packaging has been accomplished by many suppliers to all types of industry. Some may require liners to enhance reuse but this option should be pursued with your suppliers.

Some facilities that generate large amounts of cardboard have found it economically

feasible to bale and sell their cardboard. Businesses with small amounts of cardboard usually give it away to a business or charity willing to pick it up. We suggest you contact your current or local recycler about the feasibility of upgrading the present recycling program or initiating one.

Information Exchange

Many avail themselves of the services of waste information and waste materials exchanges. The waste information exchange is, in effect, a clearinghouse for information. When a generator is faced with the problem of disposing of a particular waste, consideration of such factors as the cost of raw materials and waste management may prompt the solicitation of the services of a waste information exchange and, in turn, a waste material exchange for the actual removal and disposition of the waste. Participation in a waste exchange program as part of waste minimization provides an automated information system that can be accessed for the purpose of obtaining or exchanging successful waste minimization practices used throughout the country.

SUMMARY

Current pollution controls do little more than move waste around from one medium to another (i.e., air, land, and water). Therefore a comprehensive, management approach to waste is essential. Pollution prevention/waste reduction at the source is an economically sensible approach whereby dry cleaners can lower waste management and regulatory compliance costs, liabilities, and risks. Waste reduction efforts cannot eliminate all wastes, but it can help to lower costs to operators as regulations continue to increase.